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Before the
Federal Communications Commission
Washington, D.C. 20544

In the Matter of ONSAT NETWORK COMMUNICATIONS, INC. Petition for Declaratory Order That Blanket Licensing Pursuant to Rule 25.115(c) is Available for Very Small Aperture Terminal Satellite Network Operations at C-Band Petition for Waiver of Rule 25.212(d) To The Extent Necessary To Permit Routine Licensing of 3.7 Meter Transmit and Receive Stations at C-Band	)	RECEIVED SEP 10 1999 FEDERAL COMMUNICATIONS COMMISSION OFFICE OF THE SECRETARY RM-9649

PETITION FOR DECLARATORY ORDER AND WAIVER AND REQUEST FOR EXPEDITED ACTION

Onsat Network Communications, Inc. ("Onsat") hereby submits this Petition: (a) for a Declaratory Order that blanket licensing is available for C-Band satellite earth stations using Very Small Aperture Terminal ("VSAT") technology, subject to frequency coordination; and (b) for a waiver, if necessary, of 47 C.F.R. § 25.212(d) to permit Onsat to obtain routine authorizations for 3.7 meter dishes operating in the C-Band.[1] Although we hope for and expect action on this Petition before the release of an order in the pending proceeding on *Extending*

[1] Action by the Commission on the waiver portion of this Petition may be moot as a request for routine licensing for 16 of Onsat's 3.7 meter dishes has already been placed on public notice. Onsat is awaiting notification from the FCC that licensing of these dishes has been processed.

Wireless Telecommunications Services To Tribal Lands, WT Docket No. 99-266 (rel. Aug. 18, 1999), we note that the rule interpretation we suggest responds to the Commission's request in that proceeding for "satellite policies that we can adopt, or regulations that we should eliminate or streamline to promote the deployment of satellite services in tribal lands and other unserved areas." Id., ¶ 39.

* * *

Onsat is a private company founded in 1998 and headquartered in Salt Lake City, Utah. We provide satellite-based, wireless, broadband network services to schools, libraries, Internet Service Providers and other institutional customers in rural America and on tribal lands to facilitate high speed Internet and other data network access.[2] Our products are designed to extend networks and support private data transmissions, video broadcasts, and Internet services at reasonable prices.[3]

Onsat's revolutionary business plan is to provide Internet service to its rural customers without laying expensive and inefficient landlines.[4] Each additional Internet user requires more bandwidth, and additional bandwidth has traditionally required faster and more numerous landlines. But laying landlines is expensive, results in only incremental bandwidth increases, relies on the availability of installation crews, and is altogether impractical for remote locations. The further a customer is from the Internet backbone, the more difficult and expensive

2 See Onsat Corporate Overview at http://www.onsat.net.

3 See id.

4 The Commission has recently recognized that "[s]atellite technology ...represents a potential cost-effective alternative in servicing unserved communities, especially those in remote areas . . . where a limited population cannot provide the economies of scale to justify the deployment costs of a wireline network for each community." See In re Extending Wireless Telecommunications Services To Tribal Lands, Notice of Proposed Rulemaking, WT Docket No. 99-266 (rel. Aug. 18, 1999), ¶ 12 ("*Tribal Lands NPRM*").

it is for that customer to obtain high speed Internet access.[5] Because many of these rural customers find it difficult to obtain high speed dedicated lines at a reasonable price, Onsat has developed a business plan to provide service using VSAT-type links between its earth stations and its server.

Onsat provides antennae measuring 3.7 meters in diameter to its customers in order to receive, and sometimes transmit back, broadband data transmissions. These 3.7 meter antenna sites are currently located in remote parts of Wyoming and Montana, but a national network is planned. From the remote antenna sites, the data is conveyed back to the Onsat server in one of two ways. For receive-only sites, we use dedicated terrestrial copper or fiber lines to transmit the upstream requests to the Onsat server, located at a U S West head-end site in Utah. This solution is impractical where the customer is in a very rural area or has high-bandwidth needs. In these situations, we plan to have licensed earth stations to provide the upstream request to the Onsat central data center via satellite.

As Onsat grows, it becomes highly impractical and expensive to apply for each transmit and receive site individually. Needless to say, the burden of this individualized application process falls heavily on the Commission's staff as well as on us. In order to better serve more rural customers, we would like to procure a blanket license pursuant to 47 C.F.R.

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[5] At a recent hearing on broadband access, Ivan Seidenberg, Chairman of Bell Atlantic likened the hub and spoke structure of the Internet to that of the airlines:

> ...if you have no major airport close to you, it may be very difficult, slow or expensive for you to get a flight to other parts of the country. The farther you are away from the airport, the more difficulty and expense you may have. The same is true of the backbone. Only so many backbone facilities exist and most of the hubs or connection points for the backbone are located in a relatively few areas. Areas without hubs become backwaters – the airplanes flying over head with no place to land does not do a waiting customer much good.

Testimony of Ivan Seidenberg, Before the Senate Committee on the Judiciary on "Broadband: Competition and Consumer Choice in High-Speed Internet Services and Technologies," July 14, 1999.

§ 25.115(c) so that we can install our 3.7 meter C-Band dishes throughout a rural area around a hub. Such blanket licensing would carry out the Commission's commitment, expressed most recently in Chairman Kennard's *A New FCC For the 21st Century: Draft Strategic Plan* (August 1999), to rationalize and speed the licensing process and reduce barriers to entry for communications companies serving rural areas.

Onsat is aware that blanket licenses for systems using VSAT technology have typically been granted for Ku-Band operations only, and that the Commission may view rule 25.212(d) as limiting routine licensing to C-Band dishes larger than 4.5 meters. As discussed below, there is no technical or policy justification for limiting the administrative and financial benefits of blanket licensing to Ku-Band operators or the benefits of routine licensing to C-Band operators with larger dishes. As wireless spoke and hub satellite communications become more common, the Commission must modernize its rules to facilitate new services and newly served areas. Onsat cannot move forward with its business plan without the assurance that the rules permit use of VSAT technology in the manner proposed by Onsat. Accordingly, this Petition asks the Commission to make clear that Onsat may execute its business plan using VSAT technology according to the VSAT blanket licensing procedure. By giving such an assurance, the Commission can help bring affordable Internet technology and content to rural locations, and, in the process, begin to modernize its antiquated earth station licensing rules.

I. PERMITTING ONSAT TO OPERATE C- BAND 3.7 METER ANTENNAE UNDER BLANKET LICENSES WILL IMPROVE RURAL ACCESS TO ADVANCED TELECOMMUNICATIONS.

A. The Nation Has A Strong Interest In Improving Advanced Telecommunications In Rural And Other Under-Served Areas.

Internet access is becoming an increasingly critical economic and social force in the United States. The Department of Commerce estimates that electronic commerce will account for over $70 billion in sales in the year 2000, increasing to $327 billion by 2002.[6] Electronic data and content are changing the way Americans live – from on-line patient information services, to weather and travel information, on-line library collections, job banks, and government services. However, as the Commission knows, many Americans cannot access the Internet easily or cheaply. According to Chairman Kennard, there is a "digital divide" and the "technologies, skills, and infrastructure underpinning" the current level of economic growth are not uniformly available to all demographic or geographic groups.[7]

The Commission has recognized that promoting ways to bring "innovative technology to communities with a demonstrated need for it, ensures that more people have access to electronic resources."[8] For example, to promote Internet access in rural areas, the

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6 See Statement of Harris Miller, President, Information Technology Association of America, before the House Small Business Subcommittee on Empowerment, "The Digital Divide: Bridging the Technology Gap," July 27, 1999 ("*Digital Divide Hearing*").

7 See William E. Kennard, Foreward: Equality in the Information Age, 51 Fed. Comm. L.J. No. 3, 553, 555 (1999); see also Statement of Subcommittee Chairman Joe Pitts, *Digital Divide Hearing* and Statement of William Kennard on FCC Adoption of Plan to Reform Schools and Libraries Discount Procedures, June 12, 1998 (stating that the "Nation has an obligation to make sure our neediest kids have an on-ramp to the network that leads to tomorrow's opportunities.").

8 See Pitts Statement, *Digital Divide Hearing*.

Commission has been involved in projects such as the E-Rate[9] and universal service program. The Commission has also promulgated rules in the roll-out of new technologies that are designed to bring greater access to rural and under-served areas. Wireless cable operators, for example, are required to set aside a certain amount of time for educational purposes designed to meet the educational needs of underserved areas.[10] The Commission is actively encouraging wireless cable operators to use two-way technology to bring the Internet to thousands of wireless cable educational customers. In doing so, it has recognized that the best means for promoting deeper penetration and broader access is to provide operators with the widest possible flexibility in developing their business plans.[11]

Despite the Commission's recent initiatives, research indicates that the digital divide is growing. Although Internet access in classrooms increased from 35 percent in 1994 to 51 percent in 1998,[12] only 16 percent of schools in low-income areas are connected to the Internet as compared with 80 percent of schools in higher income areas.[13] This is so despite the growing importance of the Internet to education, whether it be for job searching, obtaining research data and government information, or downloading college applications and financial aid information.

A recent study by the National Telecommunications and Information Administration ("NTIA"), *Falling Through the Net: Defining the Digital Divide* (July 8, 1999)

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[9] This is the funding mechanism introduced by the Telecommunications Act of 1996 "to bring advanced technology to our nation's schools and libraries." William E. Kennard, Foreward: Equality in the Information Age, 51 Fed. Comm. L.J. No. 3, 553, 555 (1999).

[10] See In the Matter of Amendment of Parts 21 and 74 to Enable Multipoint Distribution Service and Instructional Television Fixed Service Licensees to Engage in Fixed Two-Way Transmissions, 13 FCC Rcd 19112 (1998).

[11] See id., ¶ 89.

[12] See id.

examined census data to determine access to telephones, computers and the Internet according to race, income, education and geographic location.[14] The report noted that rural Americans still lag behind the rest of the population in Internet access rates and that those rates are particularly low in Western states: for example, Wyoming (22.7 percent), Montana (21.5 percent), North Dakota (20.6 percent). In addition, households with incomes over $75,000 have five times more access to the Internet, and Asians/Pacific Islanders and whites have twice as much access as other ethnic groups.[15] Groups such as Native Americans, when and if they access the Internet, are likely to do so away from home.[16]

In its Advanced Services Report to Congress,[17] the Commission acknowledged the continuing and growing disparities in access to technology, but expressed its optimistic view that "multiple methods of increasing bandwidth are or soon will be made available to a broad range of customers" [18] and its hope that technology companies would close the gap. Onsat is dedicated to justifying the Commission's optimism in the proliferation of high-bandwidth access. If permitted to go forward in developing C-Band VSAT-like networks, we will be able to serve more and more rural institutional customers with the most advanced communications in a cost effective manner. By adopting the rule interpretations we propose, the Commission would

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13 See Statement of B. Keith Fulton, Director, Technology Programs and Policy, National Urban League, *Digital Divide Hearing*.

14 See Falling Through the Net: Defining the Digital Divide, July 8, 1999 (available at www.ntia.gov.doc).

15 Statement of Tim Robinson, Ameritech Corporation, *Digital Divide Hearing*.

16 Id.

17 See Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, 13 FCC Rcd 23699 (1999) (Section 706 Report to Congress).

18 Id., ¶ 101.

be taking a fairly small, administratively rational step that could result in more equitable service without the cost implications of the E-Rate or other more ambitious funding programs.

B. The Earth Station Licensing Rules Must Permit Variations On Existing Technologies.

As part of its effort to improve service for rural America, the Commission asks in its *Tribal Lands NPRM* how it can reduce regulatory burdens for entities seeking to use satellite technologies to deploy communications services to tribal lands and other unserved areas.[19] We commend the Commission for acknowledging the difficulties companies have in employing VSAT technologies to under-served areas under the current rules and urge it to view this Petition, in addition to its pending notice, as a way to ameliorate some of those difficulties.

Systems using VSAT technology are networks of technically identical earth stations which communicate with a larger hub station. This configuration of a single hub station and many relatively simple, remote stations allows VSAT-like systems to operate at lower cost than other satellite services or terrestrial systems. VSAT technology is increasing in popularity because it can be deployed more quickly than can traditional terrestrial systems. Quick deployment is especially advantageous in developing areas with poor terrestrial facilities,[20] and the technology has been used to implement telephony networks rapidly in rural areas where the terrain is too rough or facilities too widely dispersed to lay cable or string wires.[21]

When the VSAT rules were first implemented, the technology was used primarily by major corporations such as retailers, convenience stores, and gas stations, for data transactions

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19 See *Tribal Lands NPRM*, ¶ 39.

20 See id.

21 See Amy C. Cosper, VSATs Find Their Voice: When Terrestrial Infrastructure Falls Short, Global Telephony (Sept. 1997); Amy C. Cosper & James M. Glifford, VSAT Holdouts, 21 Satellite Communications 26 (Aug. 1997).

such as point-of-sale credit authorizations and inventory control.[22] Use of VSAT technology has changed, however, and it has now become a means for reliable Internet/intranet communications.[23] For example, Onsat's network will allow relatively high speed upstream access to the Internet (128 kb/s) and very high speed (6 mb/s) downstream access.

Unfortunately, applications for VSAT-like hub stations have outstripped the current regulatory scheme, which effectively limits VSAT use to the Ku-Band. A VSAT Ku-Band network is, as we discuss below, less reliable than a C-Band network using VSAT technology would be. In addition, by allowing companies like Onsat to obtain blanket licenses for existing C-Band infrastructure, the Commission would ensure more competition in the rural Internet access market.[24] As the Commission recognizes, competition results in lower Internet access charges, which in turn brings the Internet within the reach of more consumers.[25] We urge the Commission to update the VSAT licensing rules and/or implementation of those rules to allow more competition in the provision of advanced satellite communications services, particularly in rural areas.

II. THE COMMISSION'S RULES DO NOT PROHIBIT BLANKET LICENSING FOR C-BAND ANTENNAE.

There is no prohibition on blanket licensing for C-Band antennae. The Commission's rules make clear that operators using the Ku-Band may obtain blanket licenses for

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22 See Gino Picasso, Data in Orbit: Very Small Aperture Terminal Satellite Networks, 34 Communications News 46 (July 1997).

23 See id.

24 See Comments of Titan Wireless Regarding Service to Rural and Unserved Areas, In re Establishment of Policies and Service Rules for the Mobile Satellite Services in the 2 GHz Band, Notice of Proposed Rulemaking (IB 99-81), at 3 (Mar. 25, 1999).

25 See Miller Statement, *Digital Divide Hearing*.

small antennae.[26] but the rules do not restrict blanket licensing only to the Ku-Band. Indeed, it has been the Commission's policy to permit applicants to seek routine licensing for technology that is not explicitly covered in Commission rules "if it can be demonstrated that the . . . antenna causes equal or less interference in a reduced spacing environment."[27] The Commission is currently contemplating expanding the scope of what applications are classified as "routine."[28]

Because VSAT technology is less expensive and more flexible than are other types of satellite technology, the Commission should make clear that Onsat may use VSAT technology provided it does not disturb existing operators. C-Band spectrum can be coordinated easily to prevent interference with terrestrial and satellite operations and, if granted a blanket license for our hub stations, we would submit a coordination report for each station before it became operational. This is discussed in more detail below. Authorizing different types of VSAT technology would further the Commission's universal service and deregulatory policy objectives, and will allow operators to quickly configure systems without having to replace costly equipment or obtain expensive individual licenses for an array of earth stations.

III. IF SECTION 25.212(d) IS CONSTRUED AS IMPOSING A MINIMUM DISH SIZE ON C-BAND ROUTINE LICENSEES, THE COMMISSION SHOULD WAIVE THE RULE FOR ONSAT.

Rule 25.212(d) states that in the C-Band, "an earth station with an equivalent diameter of 4.5 meters or greater may be routinely licensed" under certain electrical constraints. This rule does not explicitly exclude dishes smaller than 4.5 meters from routine licensing, and

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26 See 47 C.F.R. § 25.115(c); see also In re Streamlining the Commission's Rules and Regulations for Satellite Application and Licensing Procedures, 10 F.C.C. Rcd. 10624, ¶ 24 (Aug. 11, 1995) (stating that dishes larger than 1.2 meters transmitting on the 14 GHz band will receive routine processing).

27 In the Matter of Comtech Antenna Corp., No. 6480DSE-ML-86, 1986 WL 291884, ¶¶ 2-3 (June 16, 1986) (routine licensing sought for a non-circular antenna).

for this reason alone Onsat's blanket license application should be eligible for routine processing. However, to the extent 47 C.F.R. § 25.212(d) is construed to impose a minimum dish size of 4.5 meters for the routine licensing of C-Band earth stations, the Commission should waive the rule with respect to Onsat.

There are, as discussed below, compelling reasons why C-Band systems using 3.7 meter dishes should be permitted to operate under a blanket VSAT license. First, according to satellite experts, "rain fade attenuation doesn't affect C-Band signals, as it does higher frequencies, yet it offers some digital compression capabilities."[29] Secondly, C-Band space segments are less expensive to lease for partial transponder service, thus making C-Band services more practical for under-served and poorer areas. Thirdly, 3.7 meter dishes at C-Band have less potential for interference than do 1.2 meter dishes at Ku-Band. 7

A. The C-Band Spectrum Provides a High Level of Signal Availability.

Most communications engineers consider a 99.99 percent signal availability desirable for efficient downloading. The C-Band spectrum is more likely to provide this level of signal availability than is the Ku-Band because the C-Band is less susceptible to rain fade. To illustrate this difference, Table 1 shows a comparison between the C-Band and the Ku-Band for rain attenuation in cities in all eight Rain Rate Regions of the CONUS ("Crane Rain Rate Model").

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[28] See Press Release, FCC International Bureau Speeds Up Earth Station Licensing: Cuts Processing Time for Routine Ku-Band Applications to 55 Days (June 24, 1999) (discussing rulemaking to streamline application procedures).

[29] Don't Count C-Band Satellite TV Business Out Yet, Users Say, Communications Daily at 4 (Apr. 30, 1999).

Table 1: Rain Fade for 99.99% Signal Availability (Telestar 5 @ 97 WL)

City	Rain Rate Regoin	C-Band Down Fade	Ku-Band Down Fade	C-Band Up Fade	Ku-Band Up Fade
Boise	B1	0.74 dB	8.04 dB	0.47 dB	5.55 dB
Denver	B2	0.38	8.63	0.54	6.04
Seattle	C	0.63	12.33	0.92	10.13
Minneapolis	D1	0.68	13.30	1.04	11.17
Chicago	D2	0.92	17.27	1.51	15.72
Atlanta	D3	0.15	20.86	2.01	20.42
Miami	E	1.66	29.76	3.25	31.53
Los Angeles	F	0.50	10.49	0.71	8.64

This table shows that for a reliable C-Band network, a factor of only 3dB or less needs to be allocated in a link budget for fading due to precipitation. Exhibit A, attached hereto, is a link budget analysis for the Onsat system under the worst case scenario for rain fade: Miami. No attempt is made here at Ku-Band link analysis. However, it can be seen that in order to obtain 99.99 percent signal availability in the Ku-Band, an extremely high amount of rain fade attenuation must be overcome. This attenuation can be overcome either by using larger antennae (higher gain) or by extracting more power from a satellite transponder (higher recurring costs). A typical Ku-Band VSAT network will take 1 or 2 percent of the available transponder power providing 99.7 percent availability to dish sizes ranging from 1.2 to 2.4 meters depending on the rain rate region. In order to obtain 99.99 percent availability, the antenna size would need to be increased by a factor of two in the most favorable rain rate regions to a factor of fourteen in the least favorable rain rate regions. These figures suggest that the Ku-Band is an impractical spectrum choice for a high speed data service that seeks 99.99 percent signal availability at a reasonable price.

B. A 3.7 Meter Antenna at C-Band is Electrically Superior for Uplink, and Equivalent for Downlink, to a 1.2 Meter Antenna at Ku-Band.

Onsat is acutely aware that the integrity of the satellite infrastructure is dependent on the directional characteristics (gain, beamwidth, and sidelobes) of the earth station antennae used. In this regard, we offer Table 2 that compares a 1.2 meter Ku-Band antenna and the Onsat 3.7 meter C-Band antenna.

Table 2:

Comparison of 1.2 Meter Ku-Band and 3.7 Meter C-Band Antennae with Circular Aperture and 60% Efficiency

Parameter	1.2 meter @12 GHz	1.2 meter @14 GHz	3.7 meter @4 GHz	3.7 meter @ 6 GHz
Gain - dBi	41.36	42.85	41.60	45.10
3dB beamwidth - degrees	1.23	1.05	1.19	0.79
15dB beamwidth - degrees	2.39	2.05	2.33	1.55

These calculations show that the Ku-Band and C-Band antennae are essentially equivalent at the downlink frequencies. Therefore, 3.7 meter C-Band dishes present no greater interference concerns than do 1.2 meter Ku-Band dishes. The calculations also show that the C-Band antenna has a higher gain and narrower beamwidth, suggesting that in fact, 3.7 meter C-Band dishes present *less* cause for interference concerns than do the smaller Ku-Band dishes. Radiation patterns for the 3.7 meter Prodelin model #1374-370 are included in Exhibit B.

IV. ONSAT'S ANTENNAE WILL NOT CAUSE UNNECESSARY INTERFERENCE IF THEY ARE ROUTINELY LICENSED IN THE VSAT SERVICE.

As described above, 3.7 meter C-Band dishes are functionally equivalent to or better than Ku-Band dishes operating under VSAT licenses. The Commission is justifiably concerned with frequency coordination issues in the context of routine licensing of 3.7 meter C-Band dishes in the VSAT service. With respect to coordination with terrestrial users of the C-Band frequencies that are shared between satellite and terrestrial users (47 C.F.R. § 25.251), we will provide a coordination report for each and every fixed earth station site in the network before beginning operation. An STA coordination will be done for every location of Temporary Fixed Earth stations in the network. A recognized frequency coordinator will provide this report in compliance with all applicable FCC and ITU regulations.[30]

To the extent that the Commission is concerned that the 3.7 meter dish Onsat uses is not in exact accordance with section 25.209 (it differs at +/-1.0 degrees from the maximum gain (boresight)), we show in Exhibit C that the potential for interference from the 3.7 meter antenna is far less than that from a 4.5 meter antenna meeting the power flux density requirement of section 25.212(d). In addition, we have provided certification from our satellite vendor Loral, that there are no U.S. domestic satellites spaced +/- 1 degree apart, and that the power flux density from our earth stations will be as indicated in our application. A model of this application is attached as Exhibit D.

CONCLUSION

Onsat's proposal to operate a system using VSAT technology with its pre-existing (and future) C-Band antennae accords with the goals of the Commission's rules as well as the Commission's desire that the entire nation have easy and affordable access to advanced communications services. An Onsat network of hub stations, subject to a blanket license, will provide low-cost Internet access to rural, institutional users, and will provide market-driven competition for already existing, higher cost VSAT networks serving these areas. Accordingly the Commission should issue a Declaratory Order that it will routinely process Onsat's application for a blanket license pursuant to 47 C.F.R. § 115(c), and will waive rule 25.212(d) to

[30] At the present time we use Comsearch Corporation of Reston, VA.

the extent necessary to allow for routine licensing of Onsat's 3.7 meter antennae. We seek expedited action on this Petition so that we may proceed to roll out service this fall.

Respectfully submitted,

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September 10, 1999

CERTIFICATE OF SERVICE

I, Kimberly K. Egan, hereby certify that a true and correct copy of the foregoing Petition for Declaratory Order and Petition for Waiver was this 10th day of September, 1999, served by hand on the following:

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EXHIBIT A

LINK BUDGET ANALYSIS – ONSAT SYSTEM DUPLEX LINK - MIAMI, FL (REMOTE SITE) AND SALT LAKE CITY (HUB SITE)

1. **Remote (Miami) to Hub (Salt Lake City)**
2. **Hub (Salt Lake City) to Remote (Miami) – Wide-Band**
3. **Hub to Remote – Narrow-Band**

Link Design: Onsat – Remote (Miami) to Hub (Salt Lake City)

Site Information

	Uplink Miami, FL	Downlink Salt Lake City, UT
Latitude:	25.77 North	40.77 North
Longitude:	20.22 West	111.88 West
AMSL:	0 meters	1000 meters
Antenna Elevation angle	54.52 degrees	40.44 degrees
Antenna Azimuth angle	214.78 deg.	143.96 deg.
Antenna Diameter	3.7 meters	3.8 meters
Polarization:	H	V
Antenna Efficiency:	60 %	70 %
Antenna Gain:	45.1 dB	43.5 dB
System Noise Temp. (Clear)		75 deg. K
Earth Station G/T		26.8 dB
Crane Rain Rate Region	E	F

Satellite Information

Satellite:	Telestar 5 (Transponder 17 C)
Longitude:	97 degrees W.
Transponder Bandwidth	36 MHz
G/T @ Miami	+0.5 dB
SFD @ Miami	- 93.2 dBW/m^2
Saturated EIRP @ Salt Lake City	39 dBW

Transponder Utilization

% of avail. Power and Bandwidth:	1.0 %
Carrier Output Backoff	24 dB
Carrier EIRP	15 dBW

Carrier Information

Modulation:	QPSK
Information Rate:	128 kb/s
FEC Coding:	Rate ½
Threshold Eb/No @ BER= !0^-7	7.0 dB

Link Calculation

<u>Downlink</u>	Clear Weather	Upfade	Downfade
Carrier EIRP (dBW)	15.0		15.0
Free Space Loss (dB)	196.07		
Rain Attenuation – 99.99% availability (dB)		3.25	0.14
Added Noise from Rain (dB)			0.45
Pointing Error Loss (dB)	0.5		
Earth Station G/T (dB)	24.8		
Boltzmann's Constant	- 228.6		
(C/No)down (dB)	71.83	68.58	71.24
(C/Io)down – total (dB)	71.0		
(C/No+Io) down (dB)	68.4	66.6	68.1
<u>Uplink</u>			
Satellite G/T (dB)	+0.5		
SFD (dBW/m^2)	- 93.2		
Carrier Input Backoff (dB)	26.0		
Flux Density @ Satellite (dBW/m^2)	- 119.2		
Isotropic Gain (dB)	-37.0		
Boltzmann's Constant	- 228.6		
Rain Attenuation (dB)		3.25	
(C/No)up (dB)	72.45	69.20	
(C/Io)up – total (dB)	71.0		
(C/No+Io) up (dB)	68.65	67.0	
<u>Total Link</u>			
(C/No+Io)system (dB)	65.5	63.8	65.4
Threshold Eb/No (dB)	7.0		
Implementation Loss (dB)	1.0		
Threshold (C/No+Io)system (dB)	59.1		
Excess Margin (dB)	6.4	4.1	6.3
<u>Uplink EIRP and EIRP density per 4 kHz</u>			
Flux density at the satellite (dBW/m^2)		-119.2	
Spreading Loss (dBmeter^2		162.8	
Antenna Pointing Error (dB)		0.4	
Uplink EIRP (dB)		+44.0	
Uplink EIRP density per 4 kHz		+27.5	

Link Design: Onsat – Hub (Salt Lake) to Remote (Miami), Wide -Band

Site Information

	Downlink Miami, FL	Uplink Salt Lake City, UT
Latitude:	25.77 North	40.77 North
Longitude:	20.22 West	111.88 West
AMSL:	0 meters	1000 meters
Antenna Elevation angle	54.52 degrees	40.44 degrees
Antenna Azimuth angle	214.78 deg.	143.96 deg.
Antenna Diameter	3.7 meters	3.8 meters
Polarization:	V	H
Antenna Efficiency:	60 %	70 %
Antenna Gain:	41.7 dB	45.8 dB
System Noise Temp. (Clear)	75 deg. K	
Earth Station G/T	23.0 dB	
Crane Rain Rate Region	E	F

Satellite Information

Satellite:	Telestar 5 (Transponder 17 C)
Longitude:	97 degrees W.
Transponder Bandwidth	36 MHz
G/T @ Salt Lake	+2.0 dB
SFD @ Salt Lake	- 94.7 dBW/m^2
Saturated EIRP @ Miami	38 dBW

Transponder Utilization

% of avail. Power and Bandwidth:	16.7 %
Carrier Output Backoff	11.4 dB
Carrier EIRP	26.6 dBW

Carrier Information

Modulation:	QPSK
Information Rate:	6.0 Mb/s
FEC Coding:	Rate ¾
Threshold Eb/No @ BER= !0^-7	5.5 dB

Link Calculation

<u>Downlink</u>	Clear Weather	Upfade	Downfade
Carrier EIRP (dBW)	26.6		26.6
Free Space Loss (dB)	196.0		
Rain Attenuation – 99.99% availability (dB)		.11	0.53
Added Noise from Rain (dB)			1.45
Pointing Error Loss (dB)	0.5		
Earth Station G/T (dB)	23.0		
Boltzmann's Constant	- 228.6		
(C/No)down (dB)	81.7	81.6	79.72
(C/Io)down – total (dB)	85.8		
(C/No+Io) down (dB)	80.3	80.2	78.8

<u>Uplink</u>

Satellite G/T (dB)	+2.0		
SFD (dBW/m^2)	- 94.7		
Carrier Input Backoff (dB)	13.4		
Flux Density @ Satellite (dBW/m^2)	- 108.1		
Isotropic Gain (dB)	-37.0		
Boltzmann's Constant	- 228.6		
Rain Attenuation (dB)		.11	
(C/No)up (dB)	83.5	83.4	
(C/Io)up – total (dB)	85.8		
(C/No+Io) up (dB)	81.5	81.4	

<u>Total Link</u>

(C/No+Io)system (dB)	77.8	77.7	76.9
Threshold Eb/No (dB)	5.5		
Implementation Loss (dB)	1.0		
Threshold (C/No+Io)system (dB)	74.3		
Excess Margin (dB)	3.5	3.4	2.6

<u>Uplink EIRP and EIRP density per 4 kHz</u>

Flux density at the satellite (dBW/m^2)	-108.1
Spreading Loss (dBmeter^2	162.7
Antenna Pointing Error (dB)	0.4
Uplink EIRP (dB)	+55.0
Uplink EIRP density per 4 kHz	+23.2

Link Design: Onsat – Hub (Salt Lake City) to Remote (Miami) Narrow

Site Information

	Downlink Miami, FL	Uplink Salt Lake City, UT
Latitude:	25.77 North	40.77 North
Longitude:	20.22 West	111.88 West
AMSL:	0 meters	1000 meters
Antenna Elevation angle	54.52 degrees	40.44 degrees
Antenna Azimuth angle	214.78 deg.	143.96 deg.
Antenna Diameter	3.7 meters	3.8 meters
Polarization:	H	V
Antenna Efficiency:	60 %	70 %
Antenna Gain:	41.7 dB	45.8 dB
System Noise Temp. (Clear)	75 deg. K	
Earth Station G/T	23.0 dB	
Crane Rain Rate Region	E	F

Satellite Information

Satellite:	Telestar 5 (Transponder 17 C)
Longitude:	97 degrees W.
Transponder Bandwidth	36 MHz
G/T @ Salt Lake	+2.0 dB
SFD @ Salt Lake	-94.7 dBW/m^2
Saturated EIRP @ Salt Lake City	38 dBW

Transponder Utilization

% of avail. Power and Bandwidth:	1.0 %
Carrier Output Backoff	24 dB
Carrier EIRP	15 dBW

Carrier Information

Modulation:	QPSK
Information Rate:	128 kb/s
FEC Coding:	Rate ½
Threshold Eb/No @ BER= !0^-7	7.0 dB

Link Calculation

<u>Downlink</u>	Clear Weather	Upfade	Downfade
Carrier EIRP (dBW)	15.0		15.0
Free Space Loss (dB)	196.0		
Rain Attenuation – 99.99% availability (dB)		.11	0.53
Added Noise from Rain (dB)			1.45
Pointing Error Loss (dB)	0.5		
Earth Station G/T (dB)	23.0		
Boltzmann's Constant	- 228.6		
(C/No)down (dB)	70.1	70.0	68.12
(C/Io)down – total (dB)	71.0		
(C/No+Io) down (dB)	67.5	67.4	66.3

<u>Uplink</u>

Satellite G/T (dB)	+2.0		
SFD (dBW/m^2)	- 94.7		
Carrier Input Backoff (dB)	26.0		
Flux Density @ Satellite (dBW/m^2)	- 120.7		
Isotropic Gain (dB)	-37.0		
Boltzmann's Constant	- 228.6		
Rain Attenuation (dB)		.11	
(C/No)up (dB)	72.9	72.8	
(C/Io)up – total (dB)	71.0		
(C/No+Io) up (dB)	68.8	68.8	

<u>Total Link</u>

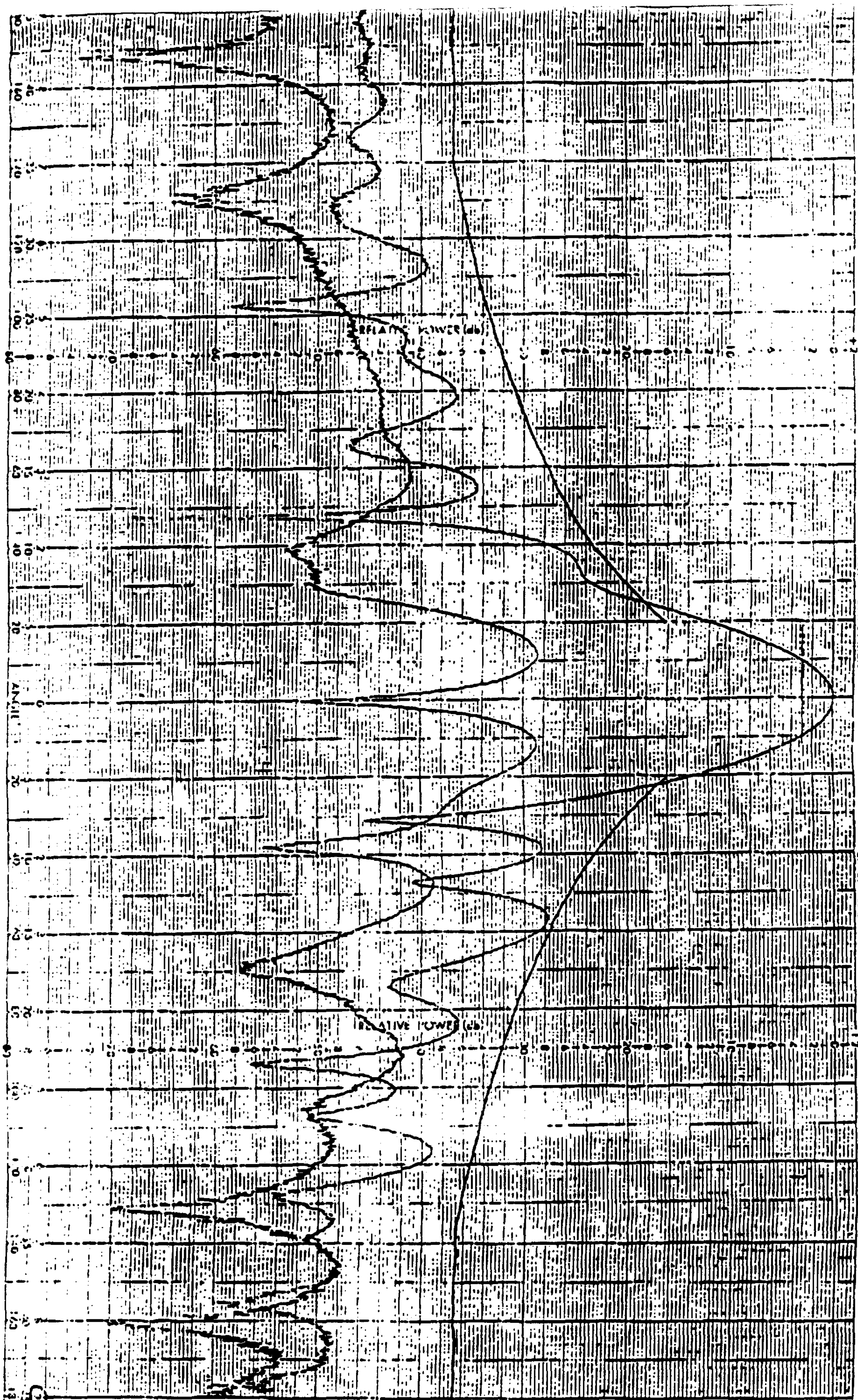
(C/No+Io)system (dB)	65.1	65.0	64.3
Threshold Eb/No (dB)	7.0		
Implementation Loss (dB)	1.0		
Threshold (C/No+Io)system (dB)	59.1		
Excess Margin (dB)	6.0	5.9	5.2

<u>Uplink EIRP and EIRP density per 4 kHz</u>

Flux density at the satellite (dBW/m^2)	-120.7
Spreading Loss (dBmeter^2	162.7
Antenna Pointing Error (dB)	0.4
Uplink EIRP (dB)	+42.4
Uplink EIRP density per 4 kHz	+25.9

EXHIBIT B

ANTENNA RADIATION PATTERN FOR PRODELIN MODEL # 1374 - 370



PROJECT 3.7m W/C-Band RX/TX FEED ENGR DBL DATE Ø5 JUN 92
REMARKS

6.425GHz H-Plane = 0° Co-Pol & X-Pol

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